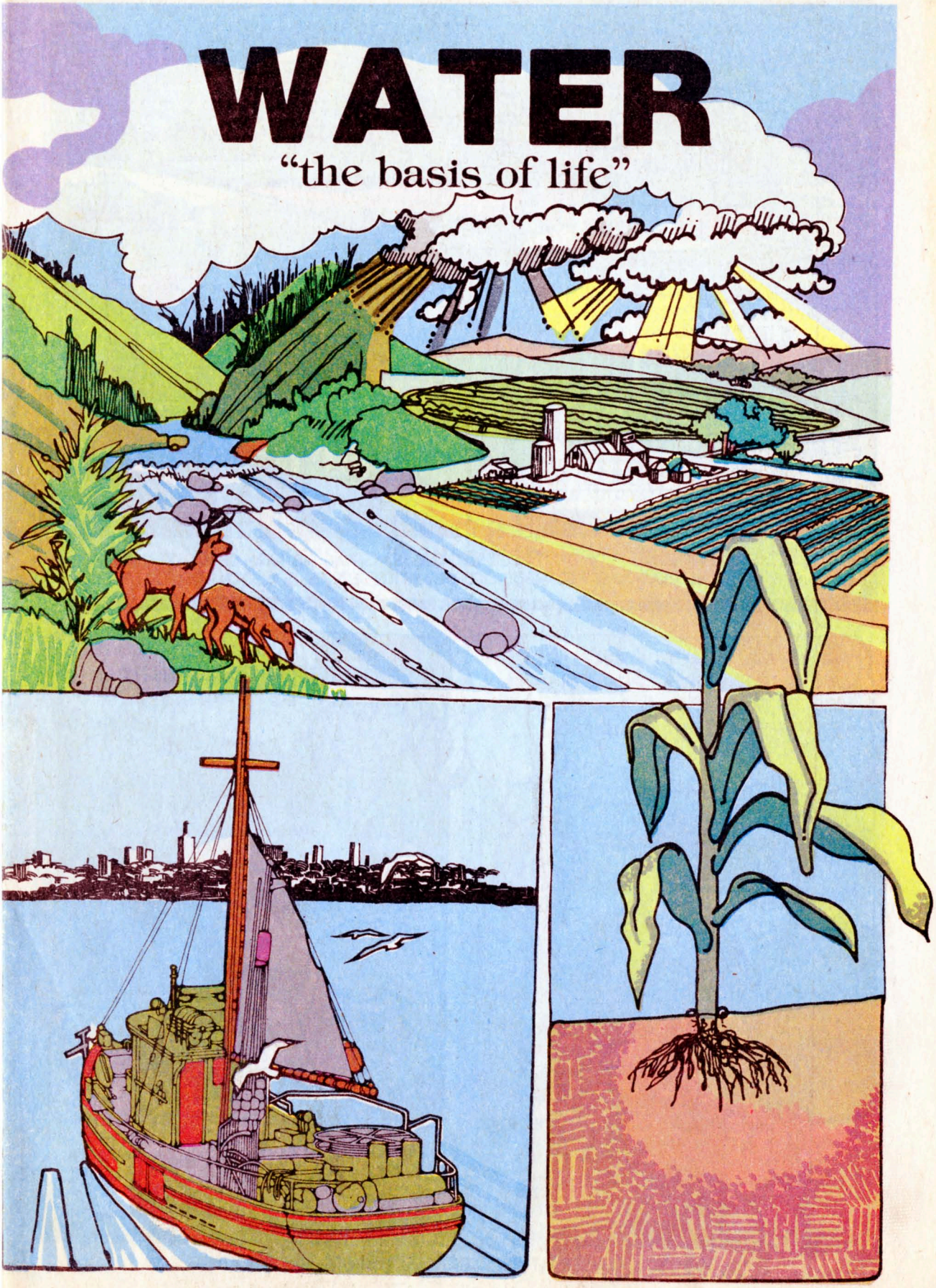
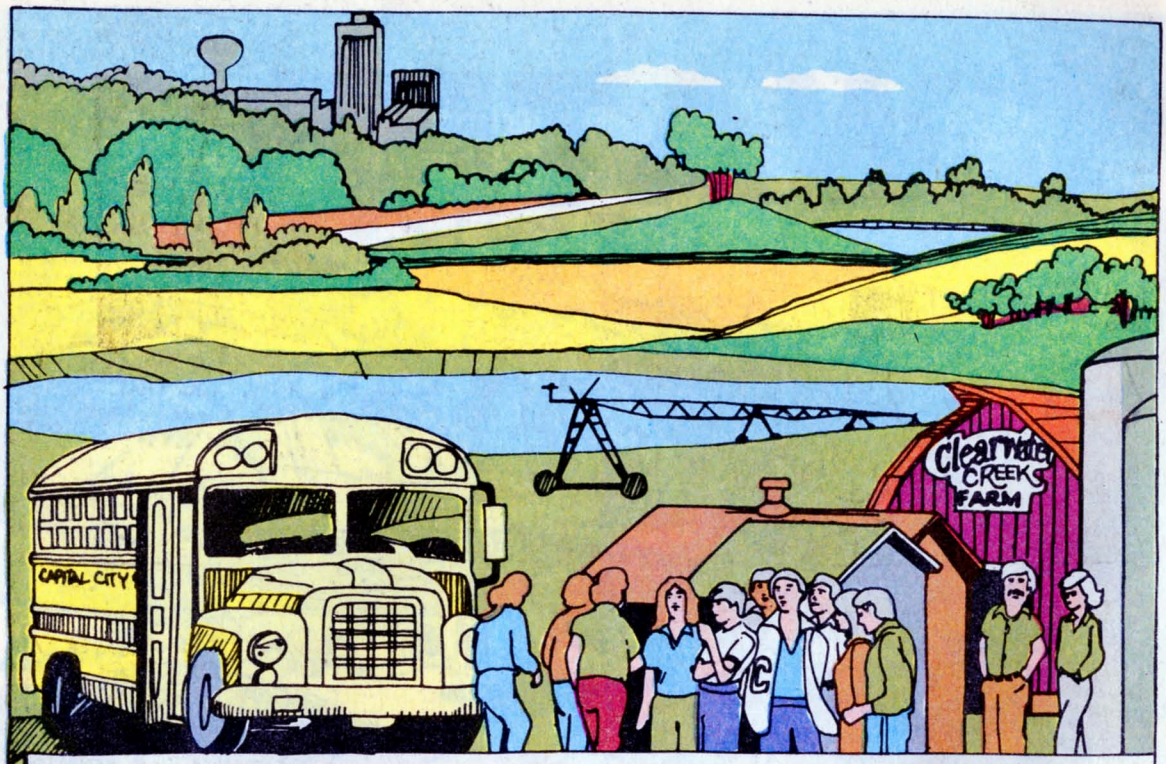
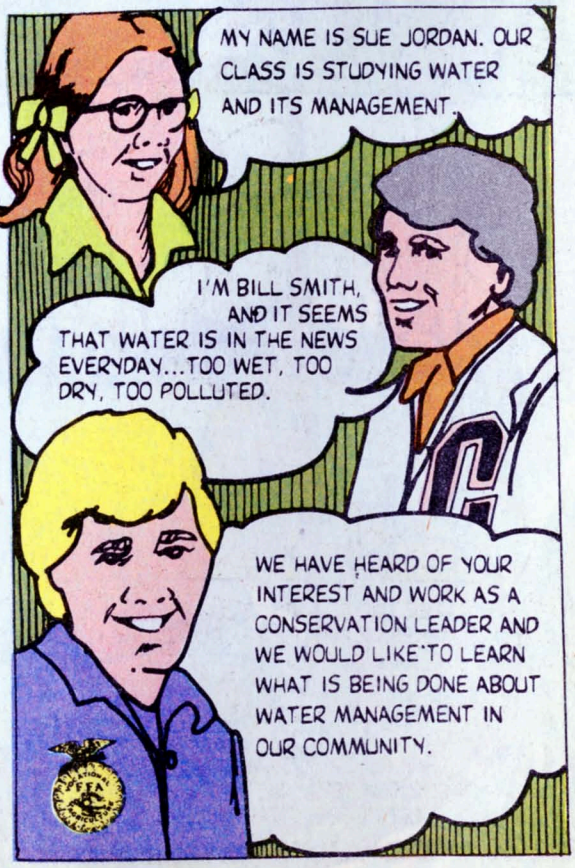
WATER

"the basis of life"





MR. TROXEL'S SCIENCE CLASS FROM CAPITAL CITY SCHOOL IS VISITING THE FARM OF MR. JOHNSON. MR. MILLS, DISTRICT CONSERVATIONIST FOR THE SOIL CONSERVATION SERVICE, IS ALSO ON HAND FOR THE VISIT.



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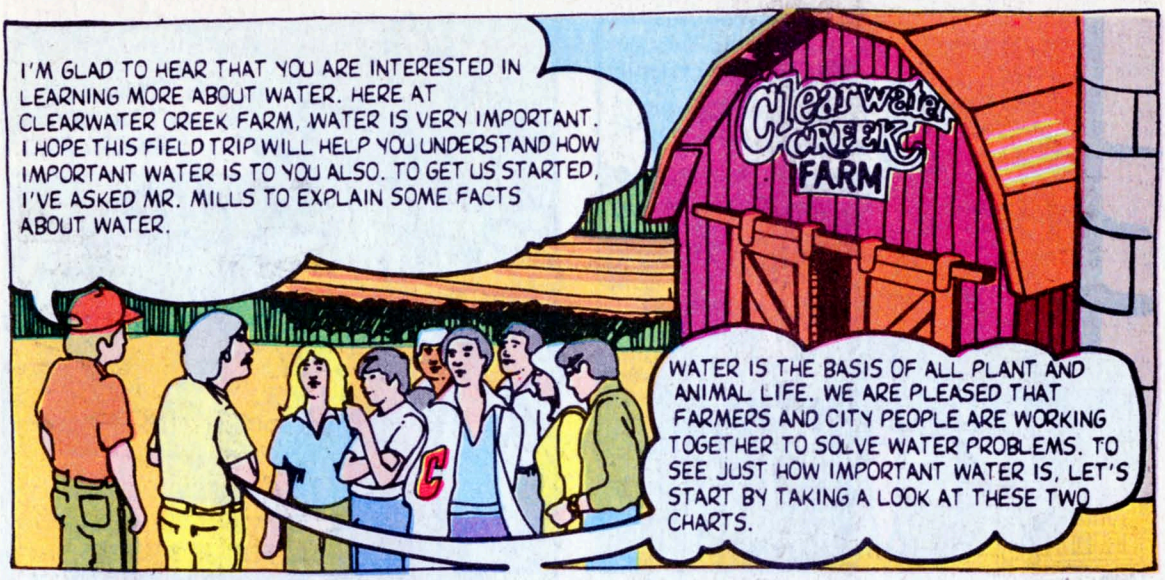
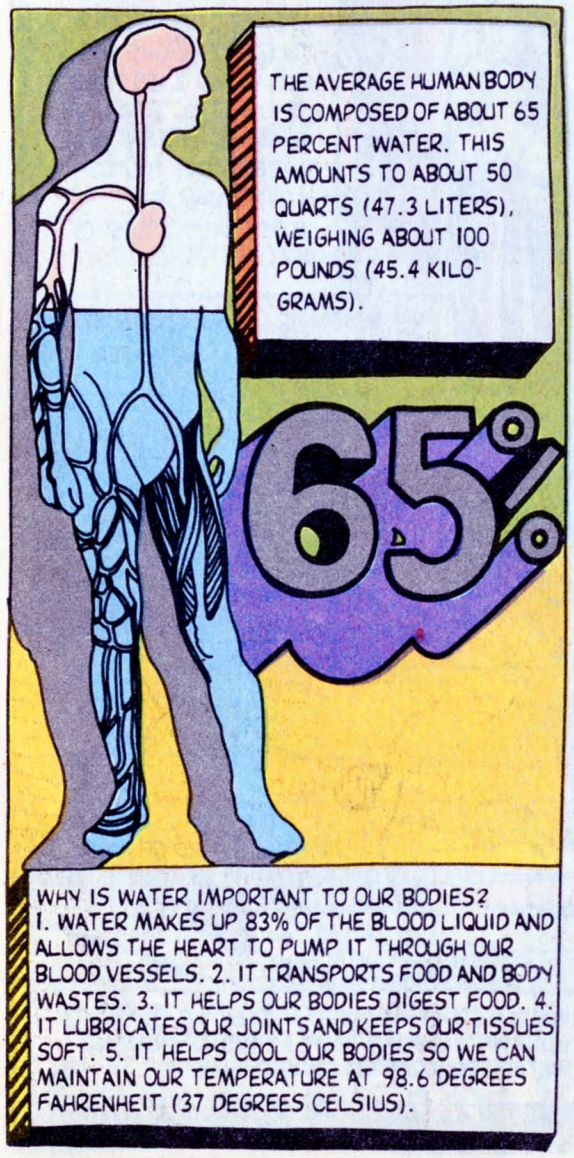
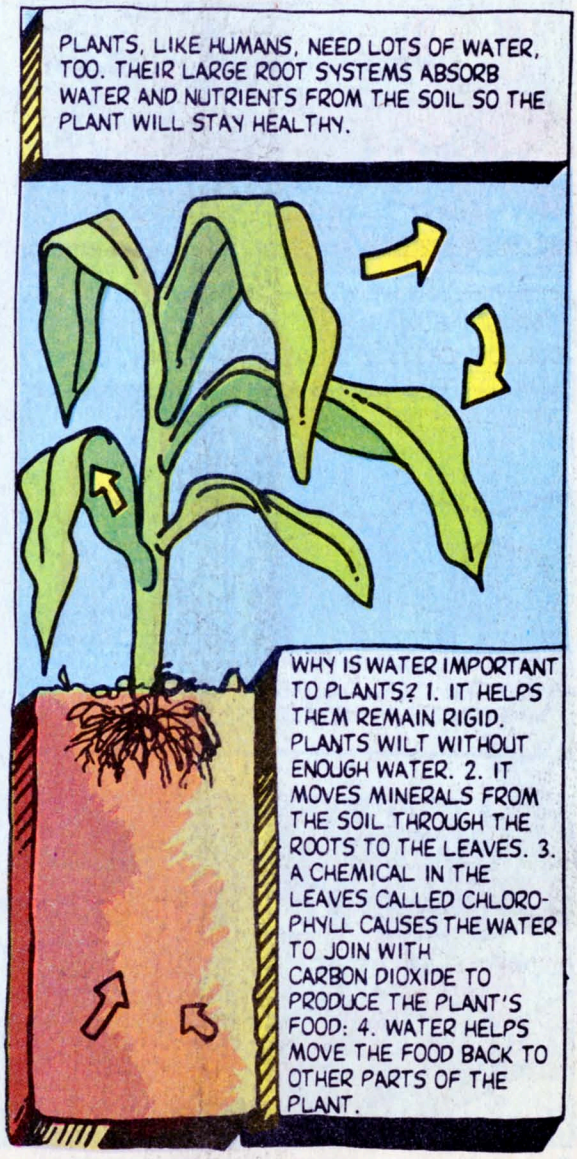
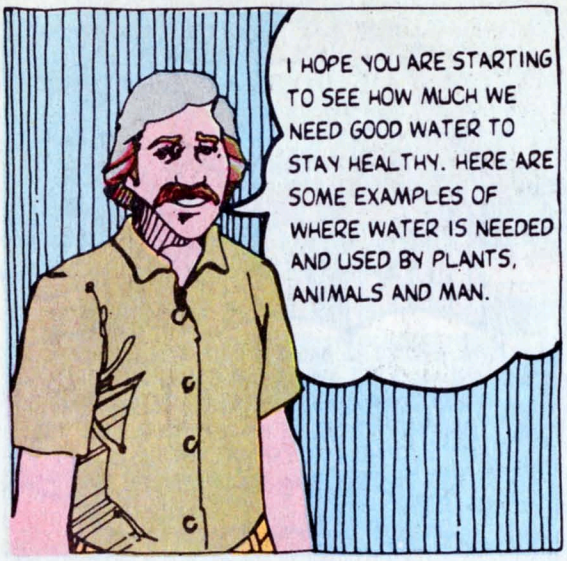
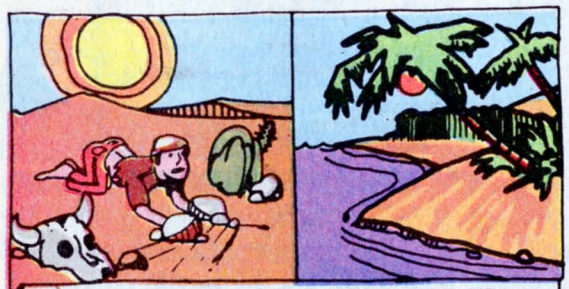

I'M GLAD TO HEAR THAT YOU ARE INTERESTED IN LEARNING MORE ABOUT WATER. HERE AT CLEARWATER CREEK FARM, WATER IS VERY IMPORTANT. I HOPE THIS FIELD TRIP WILL HELP YOU UNDERSTAND HOW IMPORTANT WATER IS TO YOU ALSO. TO GET US STARTED, I'VE ASKED MR. MILLS TO EXPLAIN SOME FACTS ABOUT WATER.
Clearwater CREEK FARM
WATER IS THE BASIS OF ALL PLANT AND ANIMAL LIFE. WE ARE PLEASED THAT FARMERS AND CITY PEOPLE ARE WORKING TOGETHER TO SOLVE WATER PROBLEMS. TO SEE JUST HOW IMPORTANT WATER IS, LET'S START BY TAKING A LOOK AT THESE TWO CHARTS.


THE AVERAGE HUMAN BODY IS COMPOSED OF ABOUT 65 PERCENT WATER. THIS AMOUNTS TO ABOUT 50 QUARTS (47.3 LITERS), WEIGHING ABOUT 100 POUNDS (45.4 KILOGRAMS).
65%
WHY IS WATER IMPORTANT TO OUR BODIES? 1. WATER MAKES UP 83% OF THE BLOOD LIQUID AND ALLOWS THE HEART TO PUMP IT THROUGH OUR BLOOD VESSELS. 2. IT TRANSPORTS FOOD AND BODY WASTES. 3. IT HELPS OUR BODIES DIGEST FOOD. 4. IT LUBRICATES OUR JOINTS AND KEEPS OUR TISSUES SOFT. 5. IT HELPS COOL OUR BODIES SO WE CAN MAINTAIN OUR TEMPERATURE AT 98.6 DEGREES FAHRENHEIT (37 DEGREES CELSIUS).

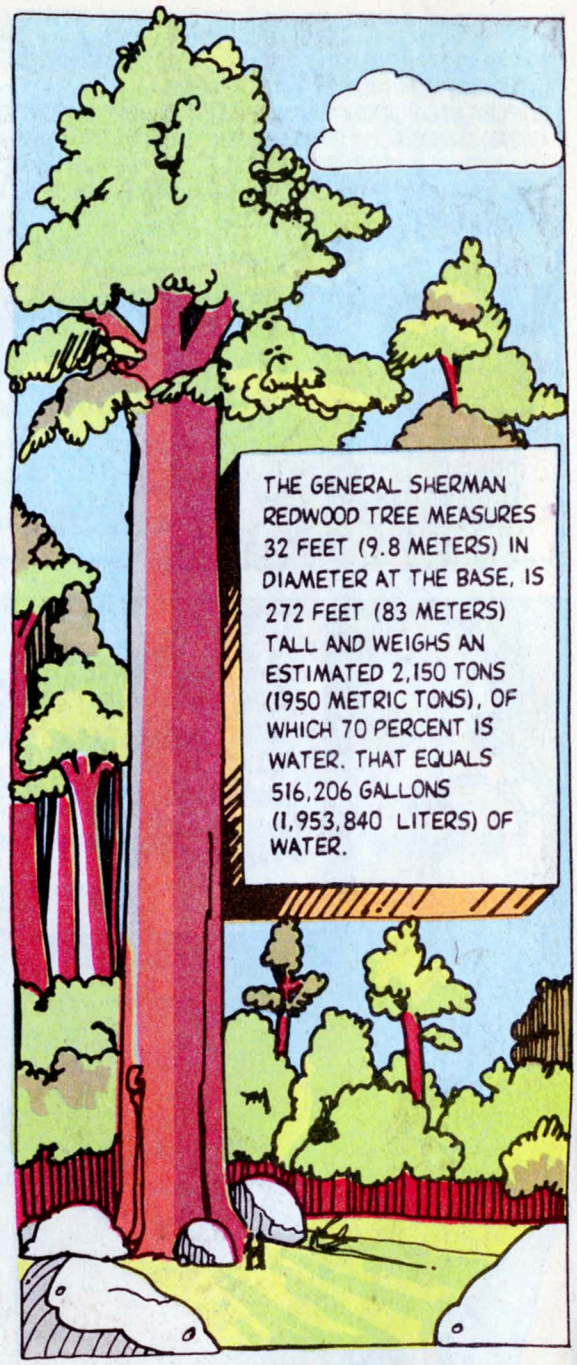

PLANTS, LIKE HUMANS, NEED LOTS OF WATER, TOO. THEIR LARGE ROOT SYSTEMS ABSORB WATER AND NUTRIENTS FROM THE SOIL SO THE PLANT WILL STAY HEALTHY.
WHY IS WATER IMPORTANT TO PLANTS? 1. IT HELPS THEM REMAIN RIGID. PLANTS WILT WITHOUT ENOUGH WATER. 2. IT MOVES MINERALS FROM THE SOIL THROUGH THE ROOTS TO THE LEAVES. 3. A CHEMICAL IN THE LEAVES CALLED CHLOROPHYLL CAUSES THE WATER TO JOIN WITH CARBON DIOXIDE TO PRODUCE THE PLANT'S FOOD: 4. WATER HELPS MOVE THE FOOD BACK TO OTHER PARTS OF THE PLANT.



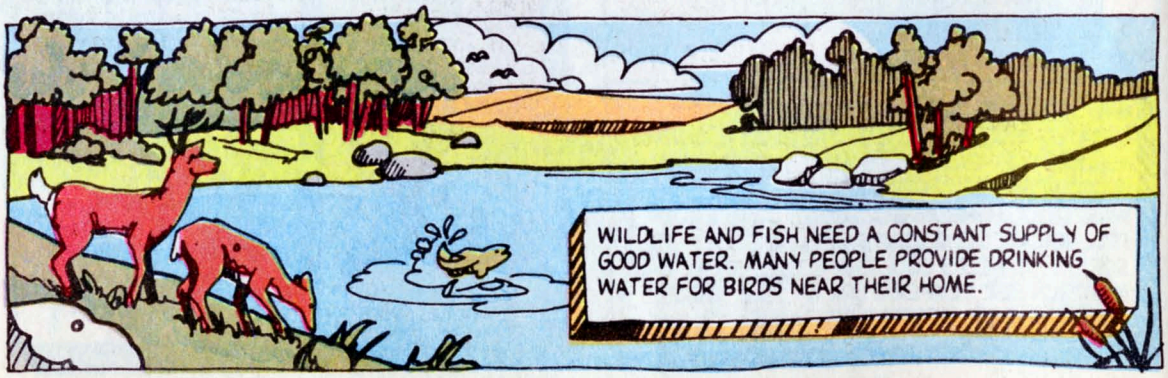


PEOPLE CAN LIVE WITHOUT FOOD FOR SEVERAL WEEKS BUT WOULD PROBABLY DIE IN A FEW DAYS WITHOUT WATER. WE OBTAIN WATER BY DRINKING AND THROUGH THE FOOD WE EAT.

LIVESTOCK NEEDS LOTS OF WATER. A DAIRY COW PRODUCING 12 GALLONS (45.4 LITERS) OF MILK PER DAY REQUIRES 36 GALLONS (136.5 LITERS) OF WATER.

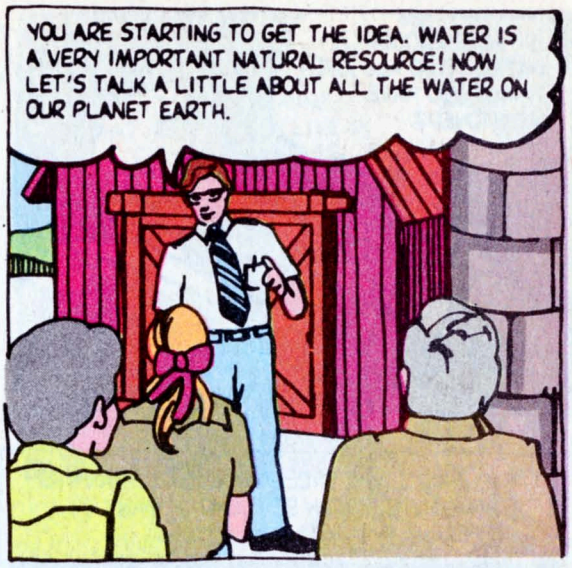


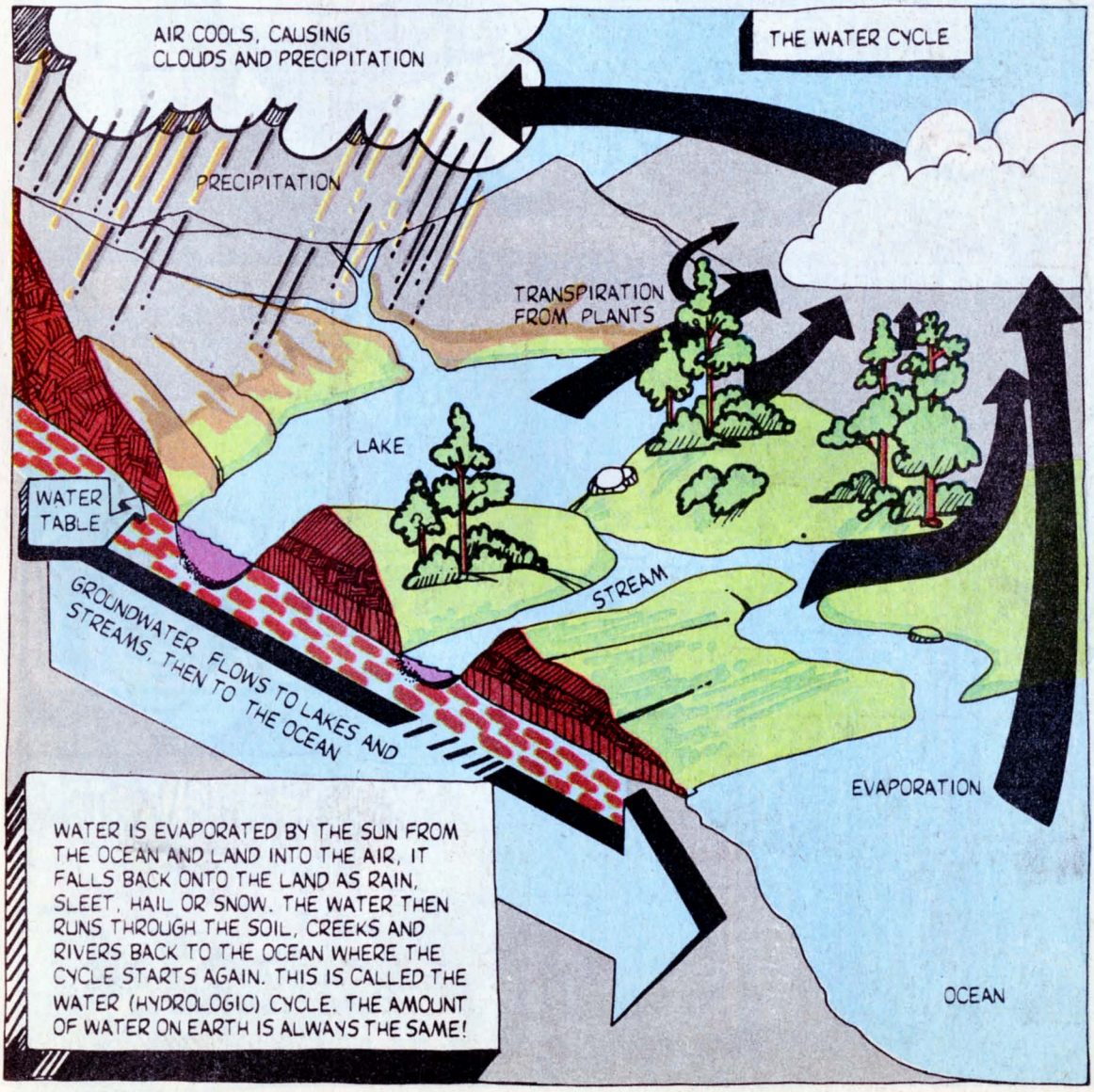
THE GENERAL SHERMAN REDWOOD TREE MEASURES 32 FEET (9.8 METERS) IN DIAMETER AT THE BASE, IS 272 FEET (83 METERS) TALL AND WEIGHS AN ESTIMATED 2,150 TONS (1950 METRIC TONS), OF WHICH 70 PERCENT IS WATER. THAT EQUALS 516,206 GALLONS (1,953,840 LITERS) OF WATER.



WILDLIFE AND FISH NEED A CONSTANT SUPPLY OF GOOD WATER. MANY PEOPLE PROVIDE DRINKING WATER FOR BIRDS NEAR THEIR HOME.

I THINK WATER IS MORE IMPORTANT THAN WE EVER DREAMED!


YOU ARE STARTING TO GET THE IDEA. WATER IS A VERY IMPORTANT NATURAL RESOURCE! NOW LET'S TALK A LITTLE ABOUT ALL THE WATER ON OUR PLANET EARTH.


AIR COOLS, CAUSING CLOUDS AND PRECIPITATION
THE WATER CYCLE
PRECIPITATION
TRANSPIRATION FROM PLANTS
LAKE
WATER TABLE
STREAM
GROUNDWATER FLOWS TO LAKES AND STREAMS, THEN TO THE OCEAN
EVAPORATION
OCEAN
WATER IS EVAPORATED BY THE SUN FROM THE OCEAN AND LAND INTO THE AIR, IT FALLS BACK ONTO THE LAND AS RAIN, SLEET, HAIL OR SNOW. THE WATER THEN RUNS THROUGH THE SOIL, CREEKS AND RIVERS BACK TO THE OCEAN WHERE THE CYCLE STARTS AGAIN. THIS IS CALLED THE WATER (HYDROLOGIC) CYCLE. THE AMOUNT OF WATER ON EARTH IS ALWAYS THE SAME!

THE HYDROLOGIC CYCLE SHOWED US THAT THE EARTH'S WATER CAN BE FOUND IN MANY DIFFERENT PLACES.

GLACIERS

OCEANS

SUBSURFACE WATER

ALTHOUGH MOST OF THE WORLD'S WATER IS FOUND IN THE OCEANS, WE ARE MOST CONCERNED WITH THE RELATIVELY SMALL QUANTITIES OF GROUNDWATER, SURFACE WATER AND ATMOSPHERIC WATER FROM WHICH WE GET OUR WATER SUPPLIES.

SURFACE WATER

ATMOSPHERIC WATER

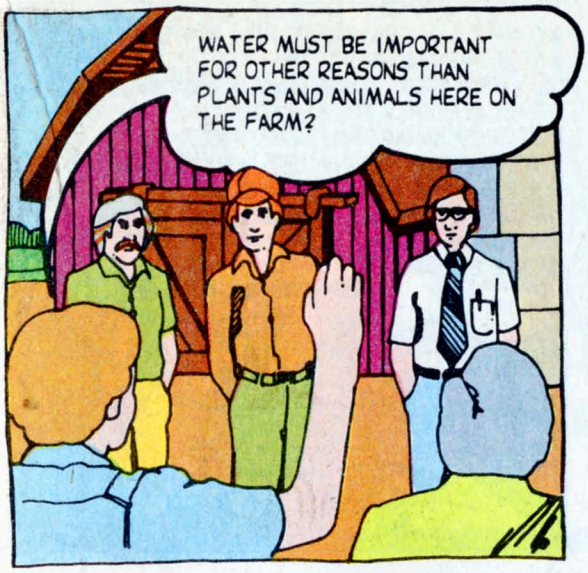
OCEANS 97.2% LARGE BODIES OF SALT WATER THAT COVER ABOUT 71% OF THE EARTH, SUCH AS THE ATLANTIC AND PACIFIC.

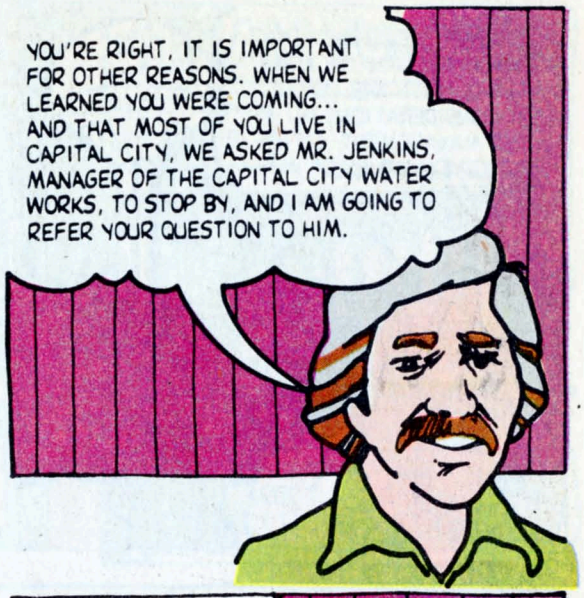
GLACIERS & ICE CAPS 2.15% FRESH WATER FROZEN INTO ICE, FOUND IN THE ARCTIC AND ANTARCTICA OCEANS.

SUBSURFACE WATER .63% FRESH WATER FOUND BENEATH THE GROUND, USUALLY BROUGHT UP BY PUMPS.

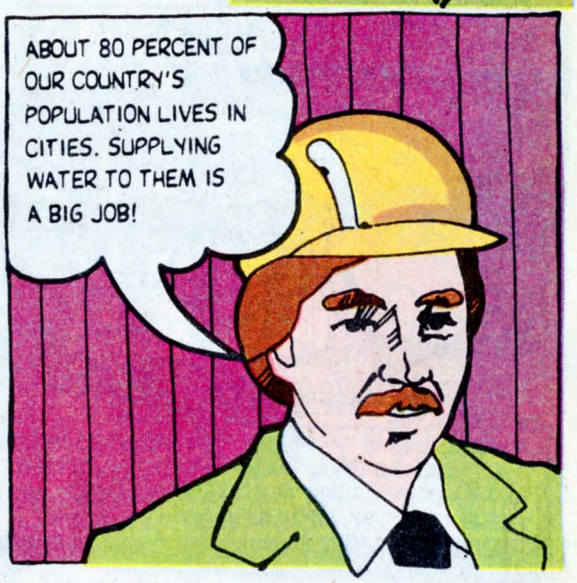
SURFACE WATER .02% FRESH WATER FOUND IN LAKES, RIVERS, AND RESERVOIRS.

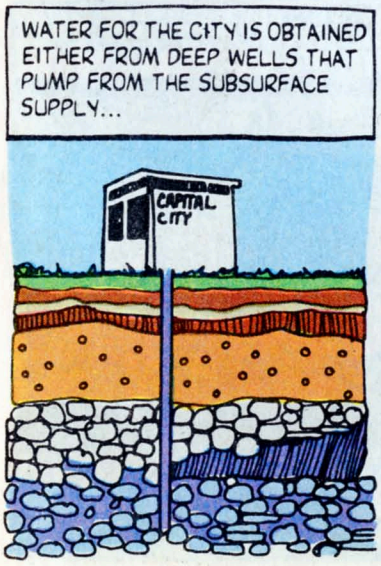
ATMOSPHERE .001% WATER HELD IN THE AIR AS WATER VAPOR.

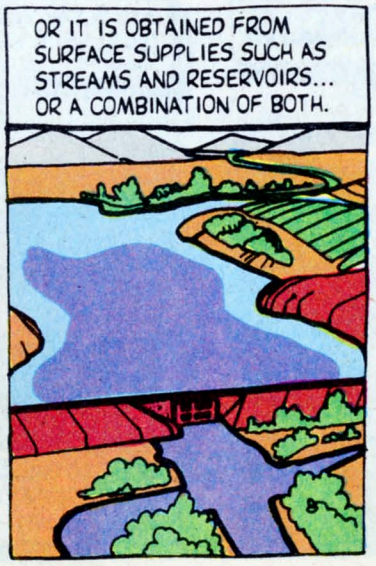

WATER MUST BE IMPORTANT FOR OTHER REASONS THAN PLANTS AND ANIMALS HERE ON THE FARM?


YOU'RE RIGHT, IT IS IMPORTANT FOR OTHER REASONS. WHEN WE LEARNED YOU WERE COMING... AND THAT MOST OF YOU LIVE IN CAPITAL CITY, WE ASKED MR. JENKINS, MANAGER OF THE CAPITAL CITY WATER WORKS, TO STOP BY, AND I AM GOING TO REFER YOUR QUESTION TO HIM.

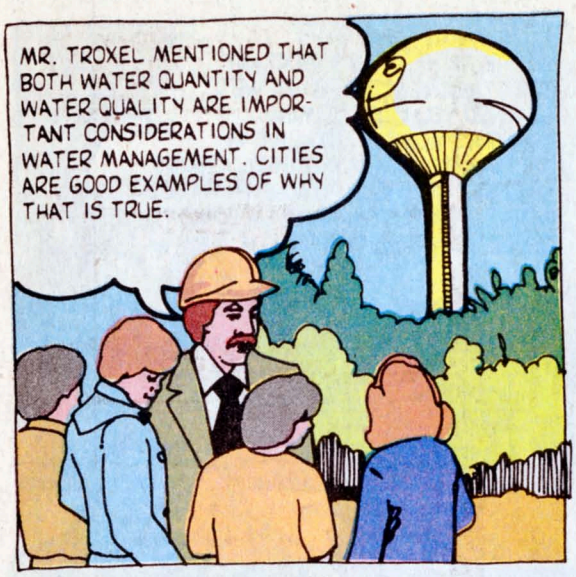
THANKS! YOU CERTAINLY LEFT A TOUGH QUESTION FOR ME! HOWEVER, THIS TRIP IS AN EXCELLENT EXAMPLE OF WHY COOPERATION BETWEEN RURAL PEOPLE AND THOSE OF US WHO LIVE IN THE CITY IS SO NECESSARY. BECAUSE RURAL LAND COVERS SO MUCH AREA, MOST OF THE RAIN FALLS IN THE COUNTRY, BUT THE USE OF WATER IN THE CITY IS IMPORTANT TO THE WELL-BEING OF EVERY CITIZEN.

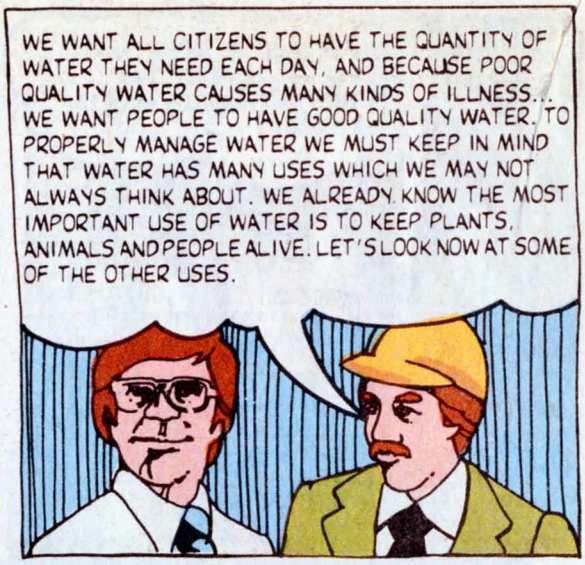

ABOUT 80 PERCENT OF OUR COUNTRY'S POPULATION LIVES IN CITIES. SUPPLYING WATER TO THEM IS A BIG JOB!

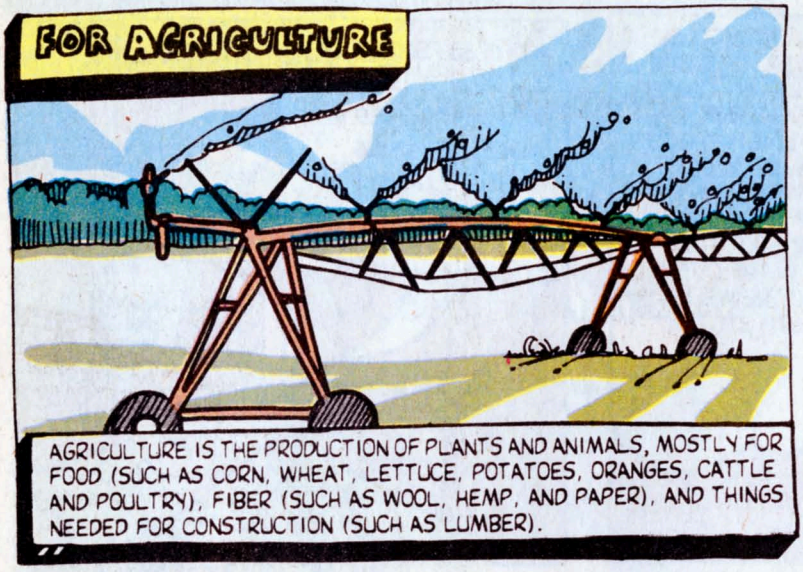

WATER FOR THE CITY IS OBTAINED EITHER FROM DEEP WELLS THAT PUMP FROM THE SUBSURFACE SUPPLY...
CAPITAL CITY

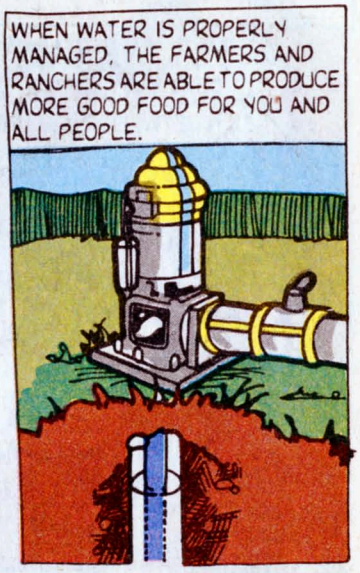

OR IT IS OBTAINED FROM SURFACE SUPPLIES SUCH AS STREAMS AND RESERVOIRS... OR A COMBINATION OF BOTH.

THE AVERAGE PERSON LIVING IN THE CITY USES ABOUT 150 GALLONS (568 LITERS) OF WATER A DAY.

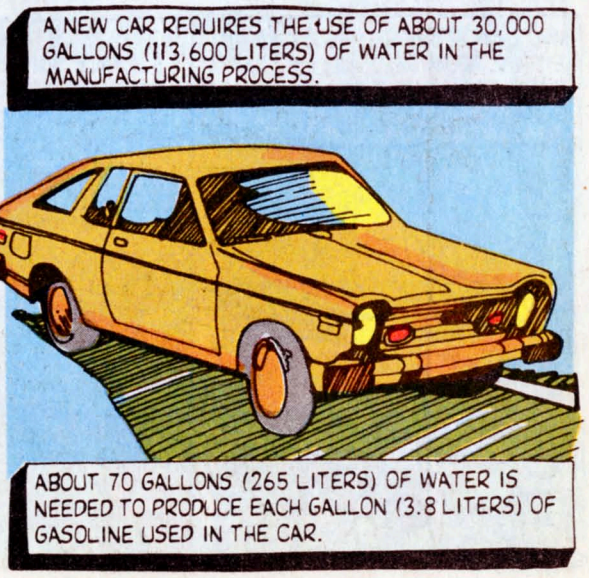

MR. TROXEL MENTIONED THAT BOTH WATER QUANTITY AND WATER QUALITY ARE IMPORTANT CONSIDERATIONS IN WATER MANAGEMENT. CITIES ARE GOOD EXAMPLES OF WHY THAT IS TRUE.

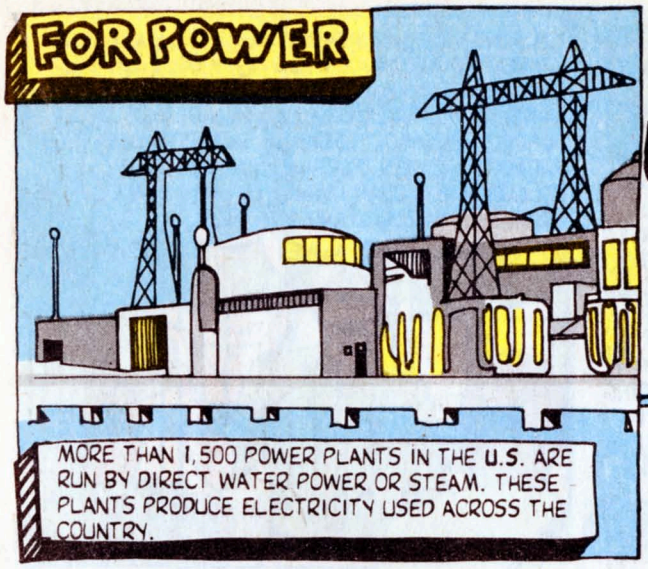

WE WANT ALL CITIZENS TO HAVE THE QUANTITY OF WATER THEY NEED EACH DAY, AND BECAUSE POOR QUALITY WATER CAUSES MANY KINDS OF ILLNESS... WE WANT PEOPLE TO HAVE GOOD QUALITY WATER. TO PROPERLY MANAGE WATER WE MUST KEEP IN MIND THAT WATER HAS MANY USES WHICH WE MAY NOT ALWAYS THINK ABOUT. WE ALREADY KNOW THE MOST IMPORTANT USE OF WATER IS TO KEEP PLANTS, ANIMALS AND PEOPLE ALIVE. LET'S LOOK NOW AT SOME OF THE OTHER USES.

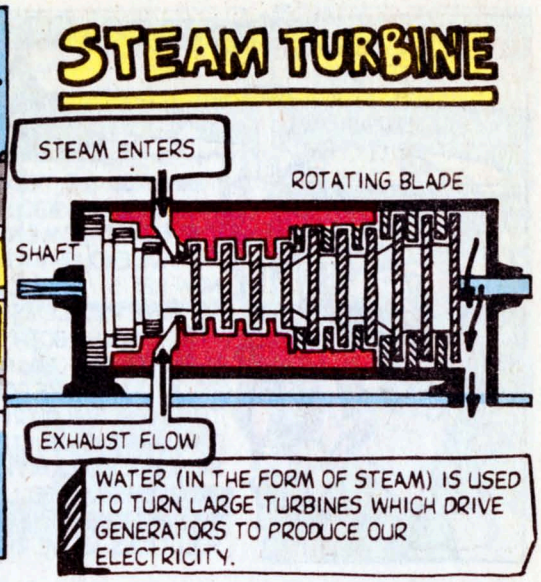

FOR AGRICULTURE
AGRICULTURE IS THE PRODUCTION OF PLANTS AND ANIMALS, MOSTLY FOR FOOD (SUCH AS CORN, WHEAT, LETTUCE, POTATOES, ORANGES, CATTLE AND POULTRY), FIBER (SUCH AS WOOL, HEMP, AND PAPER), AND THINGS NEEDED FOR CONSTRUCTION (SUCH AS LUMBER).

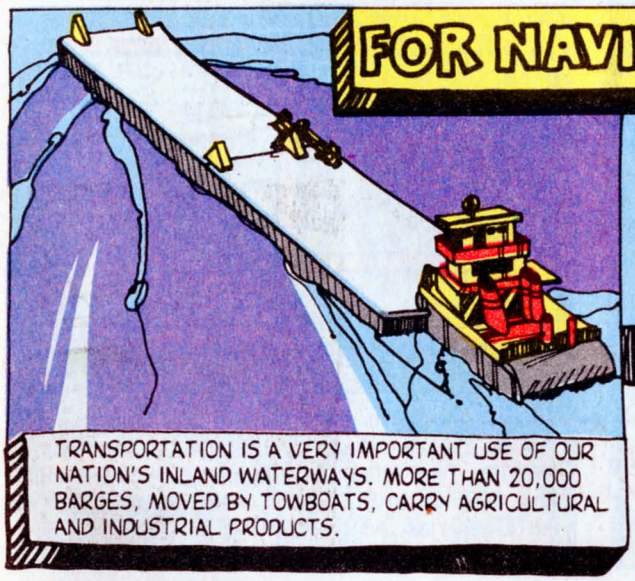

WHEN WATER IS PROPERLY MANAGED, THE FARMERS AND RANCHERS ARE ABLE TO PRODUCE MORE GOOD FOOD FOR YOU AND ALL PEOPLE.

FOR MANUFACTURING

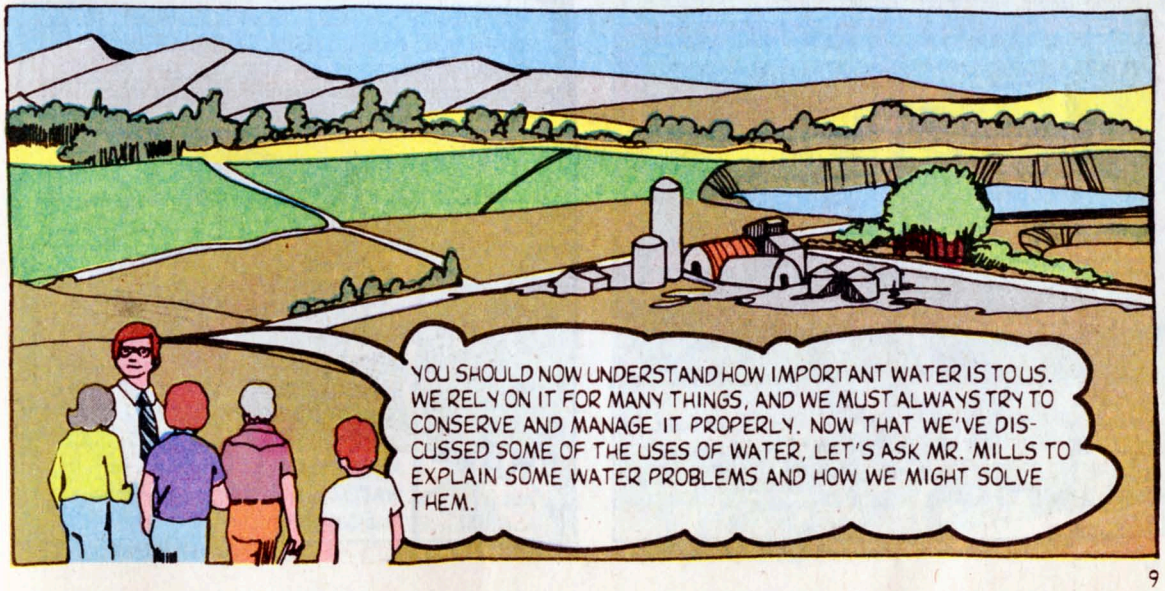

A NEW CAR REQUIRES THE USE OF ABOUT 30,000 GALLONS (113,600 LITERS) OF WATER IN THE MANUFACTURING PROCESS.
ABOUT 70 GALLONS (265 LITERS) OF WATER IS NEEDED TO PRODUCE EACH GALLON (3.8 LITERS) OF GASOLINE USED IN THE CAR.

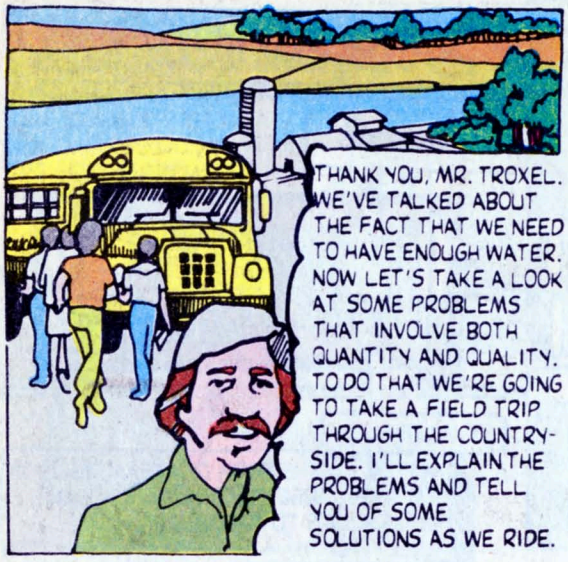

FOR POWER
MORE THAN 1,500 POWER PLANTS IN THE U.S. ARE RUN BY DIRECT WATER POWER OR STEAM. THESE PLANTS PRODUCE ELECTRICITY USED ACROSS THE COUNTRY.

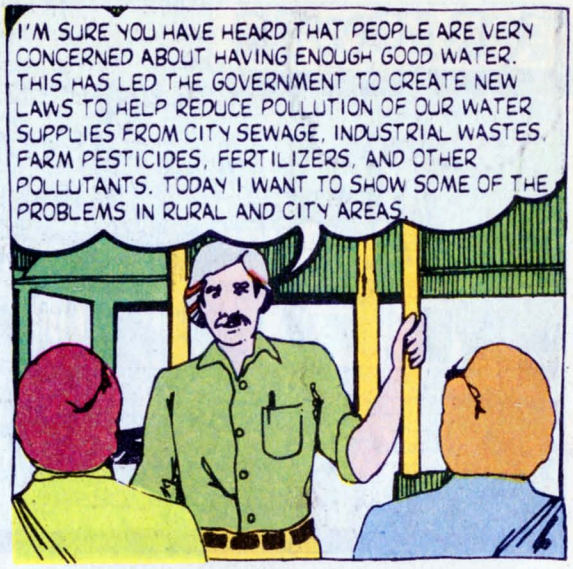

STEAM TURBINE
STEAM ENTERS
ROTATING BLADE
SHAFT
EXHAUST FLOW
WATER (IN THE FORM OF STEAM) IS USED TO TURN LARGE TURBINES WHICH DRIVE GENERATORS TO PRODUCE OUR ELECTRICITY.


FOR NAVIGATION
TRANSPORTATION IS A VERY IMPORTANT USE OF OUR NATION'S INLAND WATERWAYS. MORE THAN 20,000 BARGES, MOVED BY TOWBOATS, CARRY AGRICULTURAL AND INDUSTRIAL PRODUCTS.

THESE PRODUCTS INCLUDE GRAIN, FERTILIZERS, COAL, BUILDING MATERIALS, FUEL OIL, GASOLINE AND CHEMICALS.


YOU SHOULD NOW UNDERSTAND HOW IMPORTANT WATER IS TO US. WE RELY ON IT FOR MANY THINGS, AND WE MUST ALWAYS TRY TO CONSERVE AND MANAGE IT PROPERLY. NOW THAT WE'VE DISCUSSED SOME OF THE USES OF WATER, LET'S ASK MR. MILLS TO EXPLAIN SOME WATER PROBLEMS AND HOW WE MIGHT SOLVE THEM.





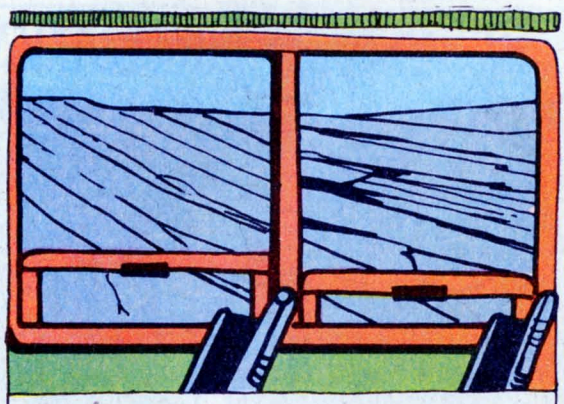
THERE ARE TWO BASIC KINDS OF WATER POLLUTION—ONE IS CALLED POINT AND THE OTHER NON-POINT.

POINT

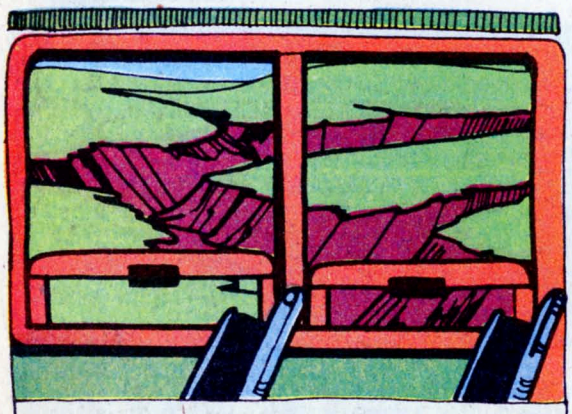
POINT POLLUTION IS A SPECIFIC SOURCE OF POLLUTION, SUCH AS A SEWAGE DISCHARGE PIPE, THAT DUMPS POLLUTANTS INTO OUR LAKES AND STREAMS.

NON-POINT

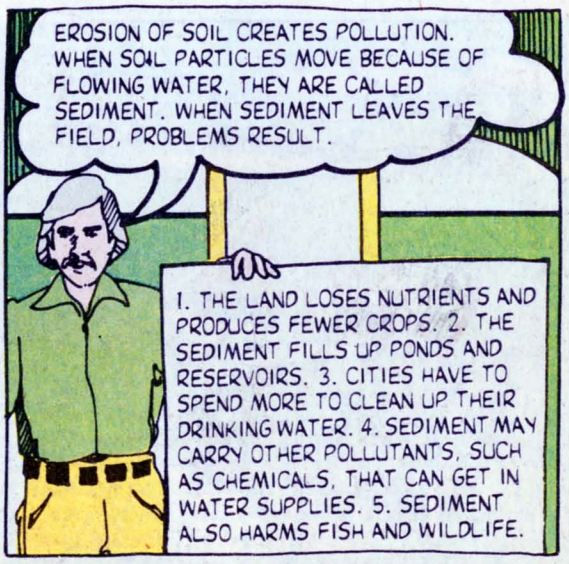
NON-POINT POLLUTION IS THE TYPE OF SOURCE THAT CANNOT GENERALLY BE PINPOINTED, SUCH AS POLLUTION CAUSED BY RUNOFF, WHICH CARRIES CHEMICALS FROM LARGE AGRICULTURAL AND URBAN AREAS INTO OUR LAKES AND STREAMS.

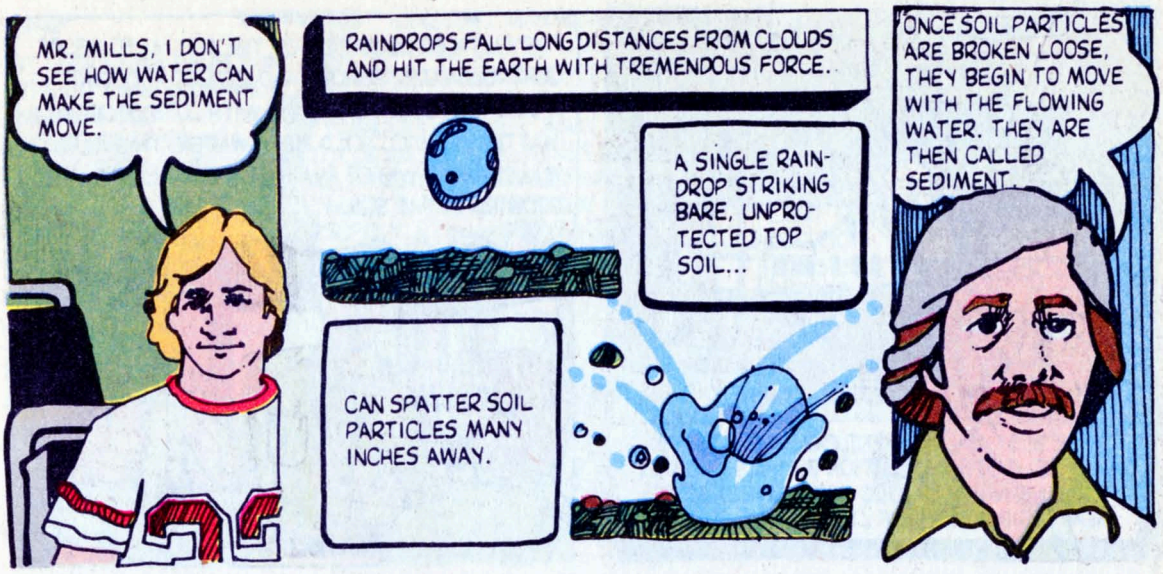


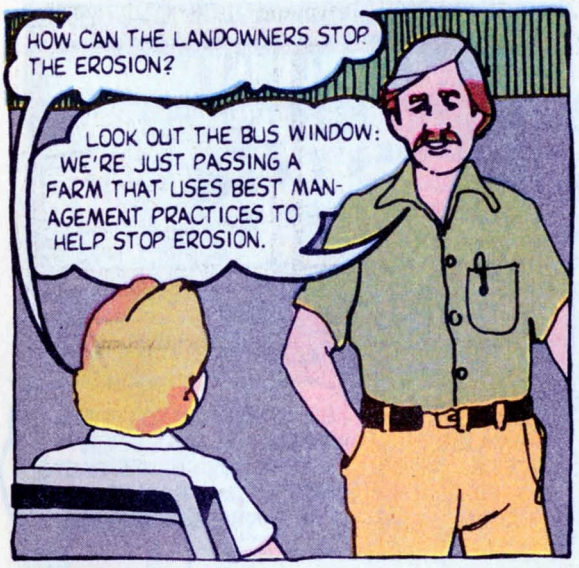
IF YOU LOOK OUT THE WINDOW, YOU WILL SEE ONE OF THE MAJOR NON-POINT POLLUTION PROBLEMS - SOIL EROSION. THIS FIELD IS AN EXAMPLE OF SHEET AND RILL EROSION WHERE SOIL IS WASHED AWAY BY WATER MOVING OVER THE ENTIRE SURFACE.

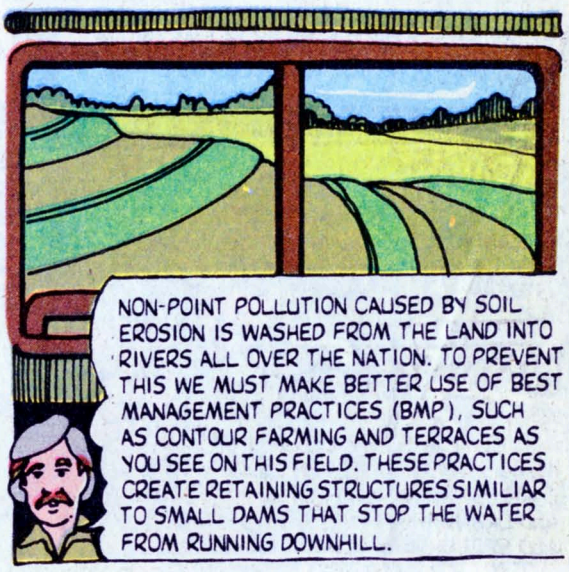


THE NEXT FIELD IS AN EXAMPLE OF SERIOUS GULLEY EROSION, WHERE THE CONCENTRATION OF WATER WASHES OUT DEEP CHANNELS THAT MAKE IT ALMOST IMPOSSIBLE TO FARM THE LAND.




MR. MILLS, I DON'T SEE HOW WATER CAN MAKE THE SEDIMENT MOVE.
RAINDROPS FALL LONG DISTANCES FROM CLOUDS AND HIT THE EARTH WITH TREMENDOUS FORCE.
A SINGLE RAIN-DROP STRIKING BARE, UNPROTECTED TOP SOIL...
CAN SPATTER SOIL PARTICLES MANY INCHES AWAY.
ONCE SOIL PARTICLES ARE BROKEN LOOSE, THEY BEGIN TO MOVE WITH THE FLOWING WATER. THEY ARE THEN CALLED SEDIMENT.

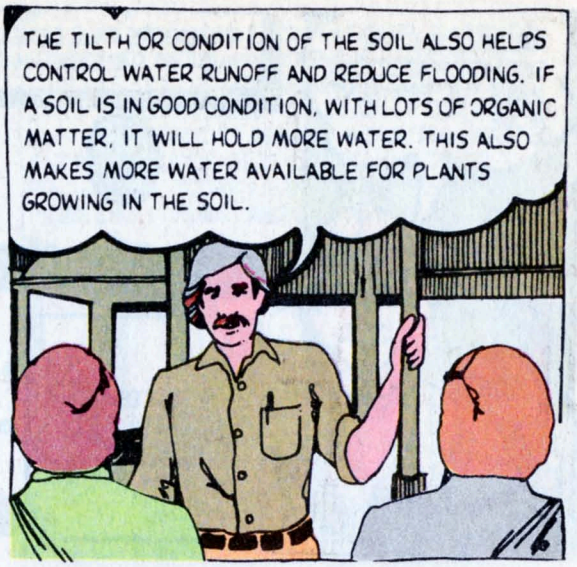

HOW CAN THE LANDOWNERS STOP THE EROSION?
LOOK OUT THE BUS WINDOW: WE'RE JUST PASSING A FARM THAT USES BEST MANAGEMENT PRACTICES TO HELP STOP EROSION.

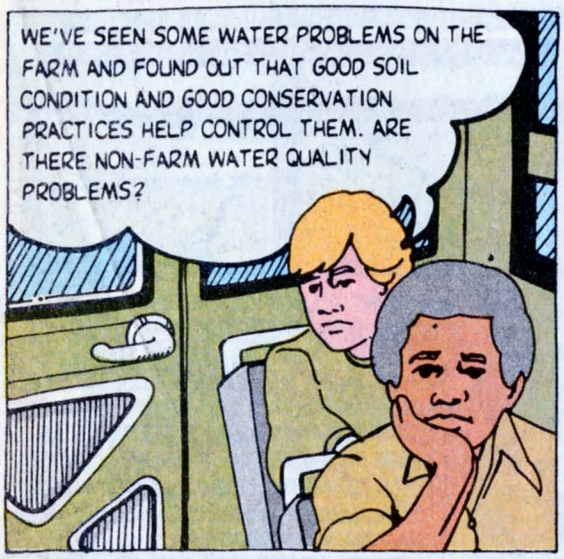

NON-POINT POLLUTION CAUSED BY SOIL EROSION IS WASHED FROM THE LAND INTO RIVERS ALL OVER THE NATION. TO PREVENT THIS WE MUST MAKE BETTER USE OF BEST MANAGEMENT PRACTICES (BMP), SUCH AS CONTOUR FARMING AND TERRACES AS YOU SEE ON THIS FIELD. THESE PRACTICES CREATE RETAINING STRUCTURES SIMILIAR TO SMALL DAMS THAT STOP THE WATER FROM RUNNING DOWNHILL.

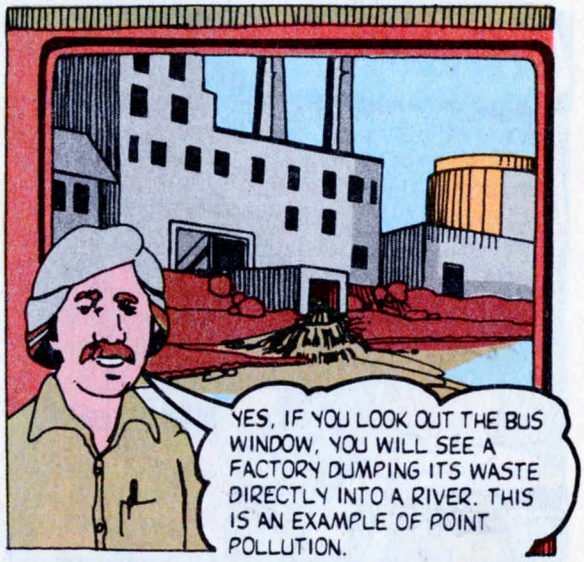
GROUND COVERS, SUCH AS HAY, GRASS AND TREES, ARE ALSO EFFECTIVE WAYS TO PREVENT EROSION AND REDUCE RUNOFF TO GIVE CLEARWATER CREEK ITS GOOD NAME.

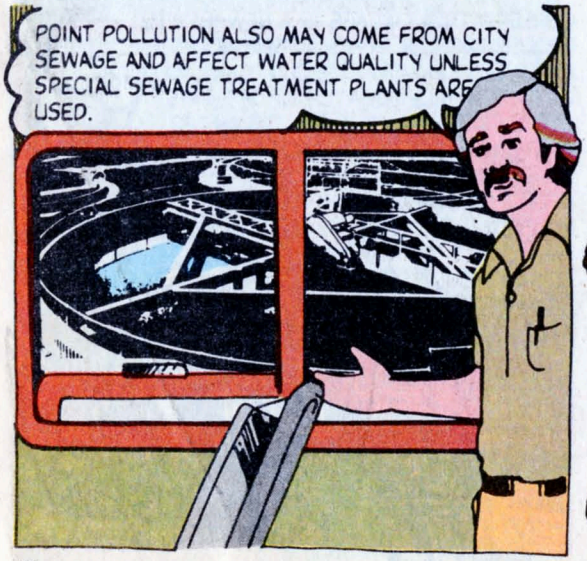
CONSERVATION TILLAGE IS A NEW WAY TO REDUCE EROSION...THE FARMER WORKS THE FIELD AND LEAVES MORE OLD PLANT MATERIAL ON THE SURFACE TO CATCH RUNOFF. THIS STOPS EROSION AND HOLDS THE WATER IN THE SOIL FOR THE PLANTS TO USE. CONSERVATION TILLAGE IS MOST EFFECTIVE WHEN USED WITH WEED CONTROL CHEMICALS, FERTILIZERS AND SOME SPECIAL EQUIPMENT.

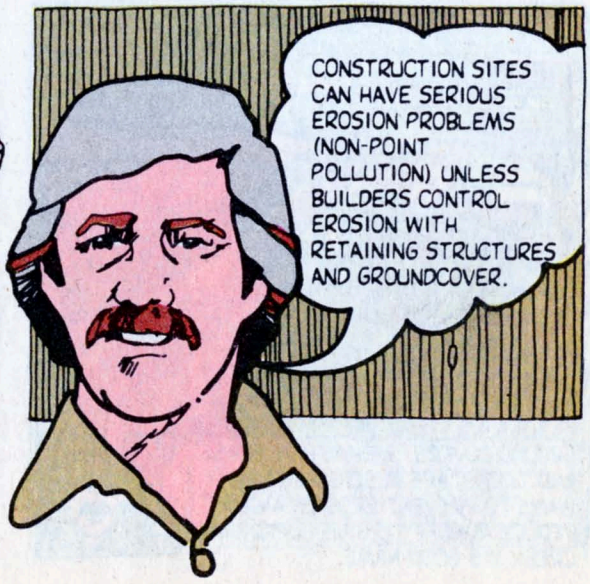
THESE BEST MANAGEMENT PRACTICES NOT ONLY HELP STOP POLLUTION BUT ALSO REDUCE FLOODING WHICH CAUSES EXTENSIVE DAMAGE AND POSSIBLY LOSS OF LIFE.

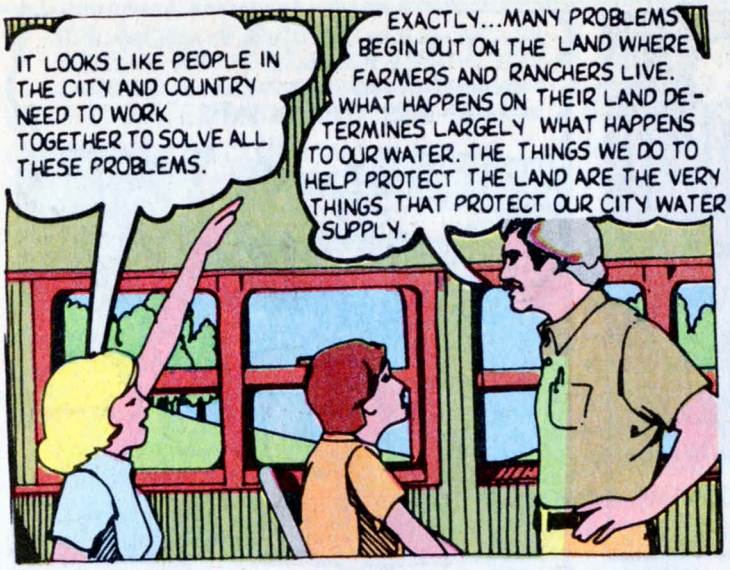

THE TILTH OR CONDITION OF THE SOIL ALSO HELPS CONTROL WATER RUNOFF AND REDUCE FLOODING. IF A SOIL IS IN GOOD CONDITION, WITH LOTS OF ORGANIC MATTER, IT WILL HOLD MORE WATER. THIS ALSO MAKES MORE WATER AVAILABLE FOR PLANTS GROWING IN THE SOIL.

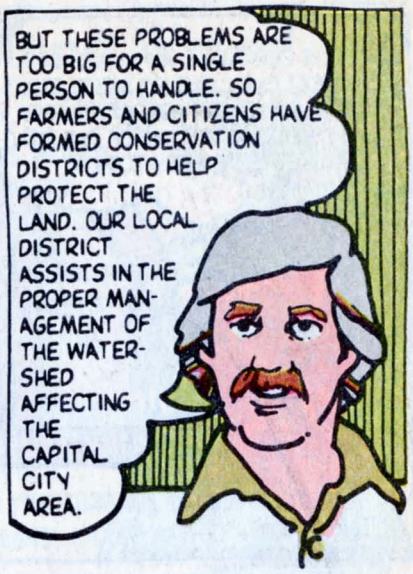

WE'VE SEEN SOME WATER PROBLEMS ON THE FARM AND FOUND OUT THAT GOOD SOIL CONDITION AND GOOD CONSERVATION PRACTICES HELP CONTROL THEM. ARE THERE NON-FARM WATER QUALITY PROBLEMS?

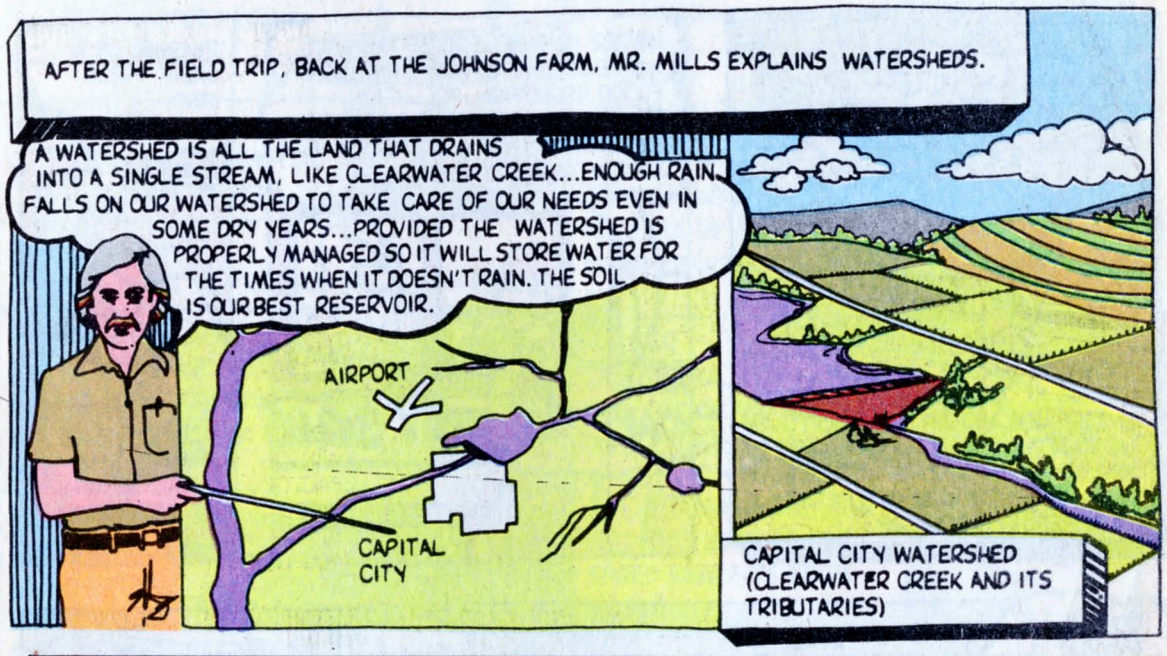

YES, IF YOU LOOK OUT THE BUS WINDOW, YOU WILL SEE A FACTORY DUMPING ITS WASTE DIRECTLY INTO A RIVER. THIS IS AN EXAMPLE OF POINT POLLUTION.

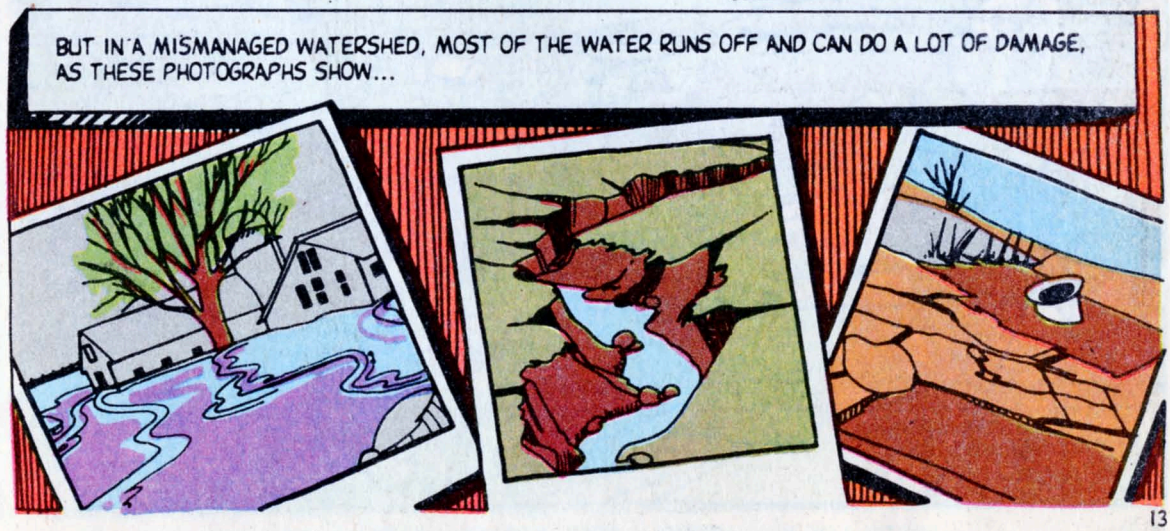

POINT POLLUTION ALSO MAY COME FROM CITY SEWAGE AND AFFECT WATER QUALITY UNLESS SPECIAL SEWAGE TREATMENT PLANTS ARE USED.


CONSTRUCTION SITES CAN HAVE SERIOUS EROSION PROBLEMS (NON-POINT POLLUTION) UNLESS BUILDERS CONTROL EROSION WITH RETAINING STRUCTURES AND GROUNDCOVER.


IT LOOKS LIKE PEOPLE IN THE CITY AND COUNTRY NEED TO WORK TOGETHER TO SOLVE ALL THESE PROBLEMS.
EXACTLY...MANY PROBLEMS BEGIN OUT ON THE LAND WHERE FARMERS AND RANCHERS LIVE. WHAT HAPPENS ON THEIR LAND DETERMINES LARGELY WHAT HAPPENS TO OUR WATER. THE THINGS WE DO TO HELP PROTECT THE LAND ARE THE VERY THINGS THAT PROTECT OUR CITY WATER SUPPLY.

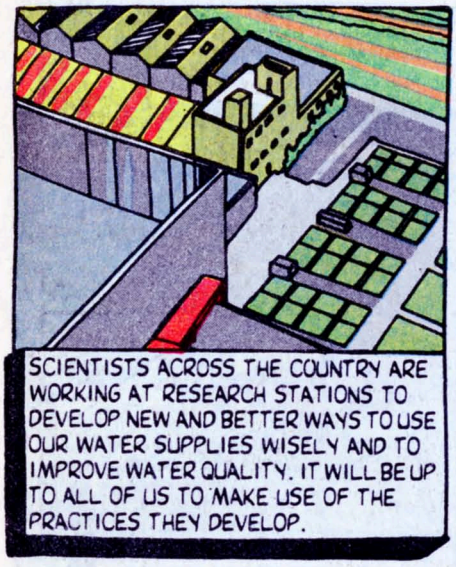

BUT THESE PROBLEMS ARE TOO BIG FOR A SINGLE PERSON TO HANDLE. SO FARMERS AND CITIZENS HAVE FORMED CONSERVATION DISTRICTS TO HELP PROTECT THE LAND. OUR LOCAL DISTRICT ASSISTS IN THE PROPER MANAGEMENT OF THE WATERSHED AFFECTING THE CAPITAL CITY AREA.


AFTER THE FIELD TRIP, BACK AT THE JOHNSON FARM, MR. MILLS EXPLAINS WATERSHEDS.
A WATERSHED IS ALL THE LAND THAT DRAINS INTO A SINGLE STREAM, LIKE CLEARWATER CREEK...ENOUGH RAIN FALLS ON OUR WATERSHED TO TAKE CARE OF OUR NEEDS EVEN IN SOME DRY YEARS...PROVIDED THE WATERSHED IS PROPERLY MANAGED SO IT WILL STORE WATER FOR THE TIMES WHEN IT DOESN'T RAIN. THE SOIL IS OUR BEST RESERVOIR.
AIRPORT
CAPITAL CITY
CAPITAL CITY WATERSHED (CLEARWATER CREEK AND ITS TRIBUTARIES)


BUT IN A MISMANAGED WATERSHED, MOST OF THE WATER RUNS OFF AND CAN DO A LOT OF DAMAGE, AS THESE PHOTOGRAPHS SHOW...

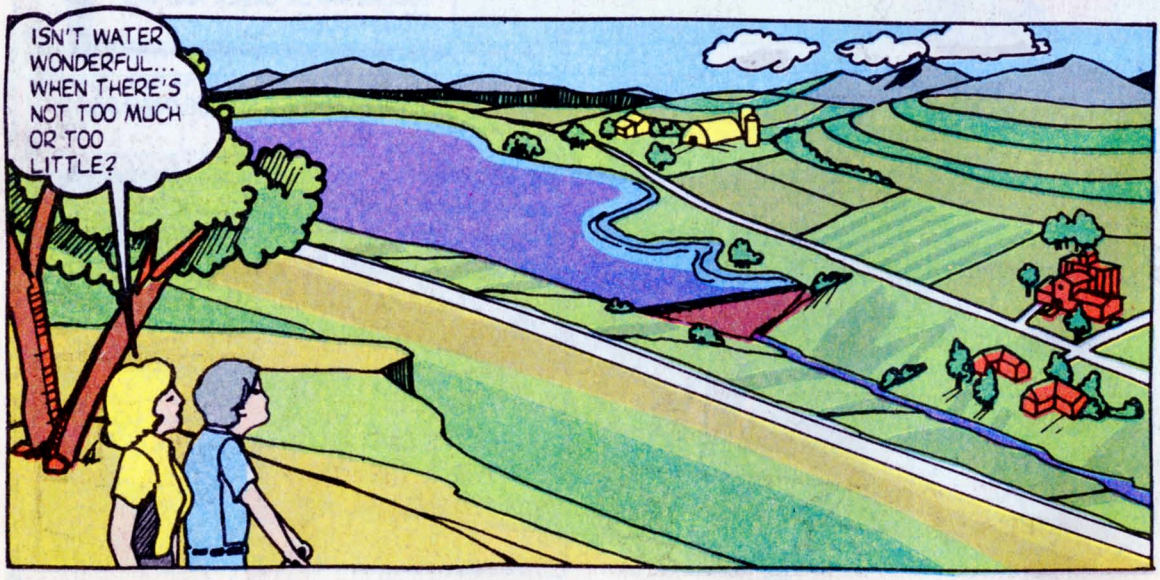
WATER IS CERTAINLY AN AMAZING RESOURCE! I'VE LEARNED MORE ABOUT WATER THAN I EVER THOUGHT EXISTED. HOW CAN WE HELP WITH SOME OF THE PRACTICES LIKE WE'VE SEEN TODAY?

YOU CAN HELP IN THE FUTURE BY KEEPING UP-TO-DATE WITH THE PROGRAMS OF YOUR CONSERVATION DISTRICT AND ENCOURAGING YOUR PARENTS AND NEIGHBORS TO DO THE SAME.
CAPITAL


SCIENTISTS ACROSS THE COUNTRY ARE WORKING AT RESEARCH STATIONS TO DEVELOP NEW AND BETTER WAYS TO USE OUR WATER SUPPLIES WISELY AND TO IMPROVE WATER QUALITY. IT WILL BE UP TO ALL OF US TO MAKE USE OF THE PRACTICES THEY DEVELOP.

WATER MANAGEMENT OF THE KIND WE'VE SEEN HERE TODAY, INCLUDING FLOOD REDUCTION, POLLUTION CONTROL, AND CONTROL OF EROSION, IS ESSENTIAL FOR A BETTER ENVIRONMENT FOR ALL CITIZENS.
CAP L CITY SCHO

THANKS FOR A GREAT FIELD TRIP.


ISN'T WATER WONDERFUL... WHEN THERE'S NOT TOO MUCH OR TOO LITTLE?

Words To Help You Understand Water!

BEST MANAGEMENT PRACTICES (BMP)
CONSERVATION PRACTICES THAT REDUCE NONPOINT WATER POLLUTION

CONSERVATION TILLAGE
A SPECIAL WAY OF TILLING THE SOIL THAT REDUCES SOIL EROSION AND CONSERVES WATER

EROSION
THE WEARING AWAY OF THE EARTH'S SURFACE BY WATER, WIND OR ICE

EVAPORATION
CHANGE IN WATER FROM A LIQUID TO A VAPOR

FLOODING
OVERFLOW OF A STREAM OR OTHER BODY OF WATER

GROUNDCOVER
PLANTS GROWN TO PROTECT SOIL FROM EROSION

HYDROLOGIC CYCLE
THE PATHWAY WATER FOLLOWS IN MOVING FROM THE ATMOSPHERE TO THE EARTH AND BACK TO THE ATMOSPHERE

IRRIGATION
PUTTING WATER ON AGRICULTURAL LAND TO HELP CROPS GROW

ORGANIC MATTER
DECAYED PLANTS AND ANIMALS THAT HELP SUPPLY THE SOIL WITH NUTRIENTS AND IMPROVE ITS TILTH

PRECIPITATION
MOISTURE FALLING FROM THE ATMOSPHERE AS RAIN, SNOW, SLEET OR HAIL

RESERVOIR
A MAN-MADE LAKE TO COLLECT AND STORE WATER

SEDIMENT
SOIL PARTICLES MOVED FROM ONE PLACE TO ANOTHER BY WATER AS A RESULT OF EROSION

SUBSURFACE WATER
ALL WATER BELOW THE SURFACE OF THE EARTH—GROUNDWATER

SURFACE WATER
ALL WATER ON THE SURFACE OF THE EARTH—IN OCEANS, LAKES AND STREAMS

TILTH
PHYSICAL CONDITION OF THE SOIL

TRANSPIRATION
RELEASE OF MOISTURE FROM PLANTS INTO THE AIR

WATER CONSERVATION
PROTECTION AND WISE USE OF WATER

WATER MANAGEMENT
METHODS USED TO GET ADDED BENEFITS FROM WATER

WATER POLLUTION
ADDITION OF MATERIAL THAT MAKES SURFACE OR SUBSURFACE WATER UNCLEAN

WATERSHED
ALL THE LAND THAT DRAINS INTO A SINGLE STREAM

WATER TABLE
LEVEL IN THE EARTH BELOW WHICH THE SOIL IS SATURATED WITH WATER

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